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Vol. VIII JUNE, 1921 No. 6

BOSTON SOCIETY OF CIVIL ENGINEERS

FOUNDED 1848

PROCEEDINGS

PAPERS IN THIS NUMBER.

"The Public Works of Modern Greece." Walter E. Spear.
Memoirs of deceased members.

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Contributors are hereby notified that proof will not be submitted to them for examination unless requested before the 10th of the month preceding the month of publication.

MINUTES OF MEETING.

BOSTON, May 18, 1921. — A regular meeting of the Boston Society of Civil Engineers was held this evening at the Society Rooms, Tremont Temple, and was called to order at 7.45 o'clock by the President, Robert Spurr Weston.

There being no quorum, Mr. Dorr moved, and it was duly seconded, that the meeting adjourn to Wednesday, May 25, at Chipman Hall, at 7.45 P.M. On a vote being taken, this motion was carried.

RICHARD K. HALE,
Acting Secretary.

BOSTON, May 25, 1921. — An adjourned meeting of the Boston Society of Civil Engineers was held this evening in Lorimer Hall, Tremont Temple, The meeting was called to order at 7.45 o'clock by the President, Robert Spurr Weston.

There were fifty members and visitors present.

The President presented the report of the Board of Government on the affiliation of the proposed Northwestern Section of the American Society of Civil Engineers with the Boston Society of Civil Engineers. On motion of Mr. Main, it was

Voted: That the report of the Board of Government on the affiliation of the proposed local section of the American Society of Civil Engineers with the Boston Society of Civil Engineers be accepted and its recommendations adopted.

The President then introduced Mr. Desmond FitzGerald, who presented a most interesting paper, entitled "Something about the Canyons of Utah." The paper was illustrated with a number of beautifully colored lantern slides.

The President announced the death of John F. Monaghan on April 18, 1921. Mr. Monaghan has been a member of the Society since January 27, 1909.

The President presented the memoir of David H. Andrews, prepared by John C. Moses and J. Parker Snow; the memoir of James C. Scorgie, prepared by John V. Peterson, and that of Louis B. Vaughan, prepared by F. E. Winsor. These memoirs were accepted and ordered to be printed in the JOURNAL.

Adjourned at 9.00 o'clock.

RICHARD K. HALE,
Acting Secretary.

REPORT ON THE AFFILIATION OF THE PROPOSED "NORTHEASTERN SECTION" OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS WITH THE BOSTON SOCIETY OF CIVIL ENGINEERS.

The members of the American Society of Civil Engineers in this territory are organizing a Section of that Society, to be known as the "Northeastern Section." At a meeting called for the purpose of considering its organization, at which about sixty were present, a committee was appointed to see if the proposed Section might be affiliated with the Boston Society of Civil Engineers.

This committee consisted of three who were members of the American Society of Civil Engineers only, and three who were also members of the Boston Society of Civil Engineers.

After careful consideration and an informal discussion with the members of the Board of Government of the Boston Society, this committee reported in favor of such affiliation as follows:

To the Local Members of the
American Society of Civil Engineers:

The undersigned Committee selected to consider and report on the feasibility of affiliating the proposed local Section of the American Society of Civil Engineers with the Boston Society of Civil Engineers respectfully submits the result of its deliberations.

We are unanimously of the opinion that affiliation is both desirable and practicable, and we recommend that it be effected in the following manner:

(1) "That the local Section of the American Society of Civil Engineers be affiliated with the Boston Society of Civil Engineers; that, as a part of the Boston Society of Civil Engineers it shall be known as the American Society of Civil Engineers Section of the Boston Society of Civil Engineers, and also that, as a local section of the American Society of Civil Engineers, it may be known as the Northeastern Section of the American Society of Civil Engineers, the New England Section, or any other name which may be chosen and approved by the parent American Society.

(2) "That the B. S. C. E. grant to the members of the Am. Soc. C. E. Section all rights and privileges accruing to full membership in the B. S. C. E., except the rights to vote, to hold office and to receive the Journal.

(3) "That the dues of the Am. Soc. C. E. Section shall be, for those who are not members of the B. S. C. E., Five Dollars per year for resident, and Three Dollars per year for non-resident, members; for those who are members of the B. S. C. E. there shall be no dues.

(4) "That the Am. Soc. C. E. Section shall pay yearly to the B. S. C. E. the sum of Five Dollars for resident and Three Dollars for non-resident Section members who are not members of the B. S. C. E.; and in addition thereto the Section shall pay yearly to the B. S. C. E., for each and every one of its members of any class, an amount equal to the per capita allowance made to the local Section by the parent Am. Soc. C. E."

By the foregoing plan, the Boston Society of Civil Engineers would undertake to furnish the use of its rooms and library, the services of its secretarial assistants, to do all printing and mailing of notices of Section meetings, to send to Section members notices of all Boston Society of Civil Engineer meetings, and to publish in its JOURNAL all suitable technical papers which may be presented by Section members to the Section or the Boston Society of Civil Engineers. In other words, by the proposed plan, existing machinery not now used to its full capacity would be at once made available to the Section, which, thus housed and equipped, would be in a much stronger position than if simply framed as a skeleton organization for discussions of national society policies. And the Boston Society of Civil Engineers at the same time would be strengthened by increased income and the greater activity centering about its headquarters.

We are strongly of the opinion that the formation of another independent local engineering organization would be a mistake and a step in the wrong direction at a time when there is a marked tendency toward coöperation and federation of engineering activities, and we believe that in recommending affiliation of the proposed Section with the Boston Society of Civil Engineers we are but following the precepts of the American Society as set forth in the rules governing the policy of local Sections adopted by the Board of Direction in 1917, which read as follows:

> "Local Sections should recognize the advantage and necessity of cooperation with other engineering organizations in all ways that may strengthen the position of engineers, develop social relations among them, or tend to establish correct principles and practice.
>
> "Local Sections should affiliate with existing engineering societies, and where none exists and conditions are favorable they should encourage their formation."

We further recommend that at the meeting to which this report is submitted, a committee be elected and empowered to effect the affiliation herein recommended, and to draft a constitution which shall embody the principles as outlined in this report.

F. A. BARBOUR, *Chairman.*
F. O. DUFOUR.
P. D. G. HAMILTON.
W. C. VOSS.
R. W. HORNE.
F. M. GUNBY.

The meeting to which this Report was made approved the recommendations and empowered the same Committee to proceed to carry out the recommendations contained in the Report.

That Committee has now drafted a Constitution and By-Laws for such a Section, and are proceeding with the necessary steps to consummate the formation of the Section, including the approval of the Constitution and By-Laws by the Board of Direction of the American Society of Civil Engineers. Copies of the proposed Constitution and By-Laws are attached. Without reading the whole of these, the following quotation from the proposed By-Laws provides for the affiliation with the Boston Society of Civil Engineers.

ARTICLE 1.

Section 1. For the better fulfilment of the " Objects " of its formation, as set forth in Article 2 of the Constitution, this Section shall be an " Affiliate Section " of the Boston Society of Civil Engineers; and, in its relation to that Society, it shall be known as the " American Society of Civil Engineers Section of the Boston Society of Civil Engineers."

Section 2. Affiliation with the Boston Society of Civil Engineers hall become effective upon the adoption of these by-laws by this Section, and acceptance of such affiliation on the part of the Boston Society of Civil Engineers.

As there are several interdependent steps in organizing this new Section, and effecting an affiliation, the committee has asked the Board of Government to present the matter to the Boston Society at this time. It will be noted that the difference between our dues for full membership and those proposed for this Section is just about equal to the cost of our JOURNAL. The Section members not members of the Boston Society of Civil Engineers would have no rights in the permanent funds.

The following are some of the advantages that would accrue to the Boston Society of Civil Engineers through the proposed affiliation:

1. It would be taking a definite step in the unification of engineering activities and sentiment in Boston and vicinity;
2. It would have centered within its headquarters the activities of another strong group in the engineering field, and should, thereby, gain additional support in the community;

3. Its professional activities should be greater because of the larger membership with a common interest;

4. Its financial position should be benefited by having some one else share in the expense and use of its quarters and secretarial staff;

5. This affiliation, if carried through, would be the first definite step in that "getting-together" of all engineering activities in this community which is so much to be desired.

In order to accomplish this affiliation, some changes will be necessary in the by-laws of the Boston Society of Civil Engineers, which were designed to provide for Sections entirely within the Society itself. The affiliation of the American Society of Civil Engineers Section could be made by making minor changes in the wording of the present by-laws of the Boston Society, as the Constitution and By-Laws of the new Section have been drafted with this affiliation in mind.

As there will doubtless be details in connection with the affiliation to be worked out as time goes on, it seems best to ask the Society to amend its by-laws, so that the Board of Government may be in a position to meet the situation as it develops, by adding the following:

> "*Affiliate Sections:* The Board of Government may, from time to time, at its discretion, establish Affiliate Sections which shall be duly organized sections of kindred societies whose objects are in harmony with those of this Society. The requirements governing such Affiliate Sections shall be those governing Sections, as provided for under these by-laws, so far as applicable, with such modification as may be approved by the Board of Government as necessary to effect suitable working arrangements, having due regard to the interest of this Society."

The suggested change in the by-laws as outlined above will provide not only for the type of Section now under discussion, but, in addition, will cover possible applications for Sections of other societies that might desire to affiliate on some different basis, and we should be prepared to meet such contingency. For instance, in Greater Boston there are about 267 members of the American Society of Civil Engineers, approximately half of whom are also members of the Boston Society of Civil Engineers. There are 411 members of the American Society of Mechanical Engineers, of whom only 33 are members of the Boston Society of Civil Engineers; and there are 209 members of the American

Institute of Electrical Engineers, of whom only 14 are members of the Boston Society of Civil Engineers. The officers of both of the latter Sections have expressed some interest in a possible scheme of affiliation. In all probability, such an affiliation would be on a somewhat different basis from that herein proposed for the Civils, whose membership is much more duplicated, and whose technical work is more closely in line with that usually followed by this Society. It is, therefore, thought best to provide for Affiliate Sections by the addition of a broad clause in the by-laws.

It is therefore recommended:

(1) That this Society approve the affiliation of the "NORTHEASTERN SECTION" of the American Society of Civil Engineers with the Boston Society of Civil Engineers along the lines laid down in this Report.

(2) That the by-laws of this Society be changed by the addition of the above clause providing for "Affiliate Sections."

For the Board of Government,
ROBERT SPURR WESTON,
President.

REPORT OF THE JOINT COMMITTEE ON THE LICENSING OF ENGINEERS.

APRIL 21, 1921.

TO THE MEMBERS OF THE
Boston Society of Civil Engineers, Board of Government,
Boston Section, American Institute of Electrical Engineers,
Boston Section, American Society of Mechanical Engineers,
Boston Society of Architects,
Boston Section, American Society of Heating and Ventilating Engineers,
Boston Section, American Institute of Mining and Metallurgical Engineers,
Boston Society of Landscape Architects,

Gentlemen,— The Joint Committee on Licensing of Engineers, which included a committee of the Boston Society of Civil Engineers and representatives of seven other societies, submitted to the members of their respective societies, on January

8, 1921, a report in which it was stated that on January 4, 1921, a petition was filed in the legislature of Massachusetts by the Boston Chapter of the American Association of Engineers, accompanied by a bill to provide for the registration of professional engineers and land surveyors. This report also stated that at a meeting of this committee, held on January 7, 1921, it was voted:

First. That legislation relative to the registration of architects and engineers by this year's session of legislature should not be recommended.

Second. That the Boston Chapter, American Association of Engineers, be requested to withdraw, for this year, its bill filed with the legislature to regulate the practice of the profession of engineering and land surveying.

This report was signed by all the thirteen members of the committee with the exception of the representative of the American Association of Engineers.

We now desire to state that the American Association of Engineers did not withdraw its petition to the legislature with its accompanying bill for the licensing or the registration of professional engineers and land surveyors, as recommended and requested in the aforesaid votes.

The character of the above bill was such that, failing its withdrawal, the committee felt strongly that the welfare of the profession demanded that it be vigorously opposed and that every effort be made to make it perfectly plain to the Committee on Mercantile Affairs of the legislature, to which the bill was referred, that it was not representative of the desires of more than a minority of the engineering profession in this Commonwealth.

As a committee whose members officially represented our various societies, we were instructed to study these matters and were free to form our own judgments in regard to them and to decide what the welfare of our respective professions demanded; but constitutional limitations made it impossible for us, as a committee, to go farther than this and oppose legislation in the names of the societies.

As individual members of our several professions, however, we were free to act according to our conscience, and as individuals we unanimously agreed to oppose the bill as actively as possible ourselves, to urge our friends in the profession to do the same, and in order that our opposition might be as effective as possible, we agreed to be collectively represented by counsel.

A hearing on the bill was held by the Committee on Mercantile Affairs of the Massachusetts legislature on February 18, 1921. The bill in question was actively favored by counsel for the American Association of Engineers. The speakers in favor of the bill, however, were only persons introduced by their counsel, all of whom were understood to be members of the association.

Both the form of the bill, which contained many glaring defects and inequalities which were contrary to the spirit of appropriate legislation, and the principle of registration were vigorously opposed in person, by counsel, or by letter, by members of the seven other societies represented on our committee, as well as by members of the American Chemical Society, the Engineering Society of Western Massachusetts, and by other individual engineers. A count of those present before the legislative committee showed nineteen persons voting in favor of the bill against eighty-nine persons opposed to it.

The legislative committee recommended the bill be referred to the next annual session of the legislature, and this recommendation was adopted in the senate on February 24, 1921, and by the house on March 3, 1921.

In opposition to the bill it was made perfectly plain at the hearing that the general public in this Commonwealth appears to make absolutely no request for the licensing of engineers, or take any interest whatever in the measure.

The demand for licensing or registering engineers in this locality, so far as we have been able to observe, appears to come entirely from the American Association of Engineers. This evidence is further confirmed by the introduction of bills for licensing or registering engineers in practically all the states of the Union and by the active campaign in support of these measures during the present year, in all states in which such laws had not already been passed, by the American Association of Engineers.

It appears to be the fact that these petitions for registration in all the different states contain the proviso that membership in the American Association of Engineers and in certain other professional societies shall be a sufficient requirement for registration as an engineer.

The reasons stated in the bills favored by this association and advanced at the committee hearing for the passage of such a bill in this Commonwealth were for the purpose of safeguarding life, health and property. The life, the health and the property of the public, it was claimed, were in the hands of the engineers who were responsible for the structures and public works that the people use or enjoy, and it was stated that existing laws did not sufficiently protect the public in these directions. It was claimed by the advocates of the bill that a licensing law such as this bill provided would furnish the necessary protection. One of the proponents at the hearing, however, was frank enough to admit that young engineers without reputation would welcome an opportunity to obtain a license which would appear to put them on a par with the better known and more experienced men in the profession.

Prof. George F. Swain pointed out at the hearing, in the clearest way possible, the character and the extent of the safeguards to the public that exist at the present time relating to the construction of buildings, public and private utilities, etc., through supervision by competent commissions and engineers, through building laws and other special laws requiring official supervision and approval of plans, inspection of work in process and of finished work, and expressed the opinion that if such measures were not sufficient that the wise policy would be to add to them and to amend them in such a way as to cure their defects, but that no possible method of registering engineers could take their place or could provide a system of safeguards to society that was comparable with them in effectiveness.

An engineer is not usually chosen in a hurry or for work of an emergency nature, and in engaging an engineer to design engineering work of greater or lesser importance, a client now considers the professional reputation and work accomplished by the engineer whom he is to employ. Public or private interests are better safeguarded by such practice than by selecting an engineer by virtue of his holding a license.

It was demonstrated at the hearing under the proposed bill, that a person who became registered, through society membership or otherwise, would be, in the eyes of the law, fully competent to practice every branch of engineering, regardless of the field in which his training or experience had been. A system of licensing which provides for competency in one field may open up an opportunity for incompetence in others.

It is an open question as to what extent licensing laws should go in the registration of applicants; if the requirements of the examining board call for professional attainments of the highest order, the result would be public confidence in a registered engineer. If licenses are issued to men of mediocre or inferior ability, many would obtain licenses and have the same standing before the public as those of much greater professional attainments and reputation, with the result that public and private interests would suffer from work of inferior character.

A favorite reason advanced for licensing laws is that they are being passed in other states, and we shall be forced to it here. This argument is obviously of the weakest character and sustains a policy of blindly following the lead of others without individual thought as to resulting benefits or disadvantages of a proposition. Many states have statutes which in others are considered inadvisable and inexpedient to copy.

One of the principal arguments that was used in favor of registration is the necessity for reciprocity with other states. The provisions of the different laws now in effect are considerably at variance in this respect. A law passed in any one state cannot compel other states to recognize their registration, and in some states requirements for registration are likely to be of a higher standard than in others, thus defeating mutual reciprocity.

Individual engineers and engineering firms and corporations which do business in several states are comparatively few in number as compared with the total number of men in the various branches of the profession. The obtaining of licenses in any one state is not a great hardship for any such, but to obtain separate licenses in a number of states is an inconvenience and source of expense.

What is an engineer? One of the greatest difficulties in licensing engineers is deciding this question. Some laws define an engineer or engineering; others avoid it entirely, leaving it in case of litigation or similar difficulty for the courts to decide. If engineers themselves, in framing laws for registration, cannot define what an engineer is, it can hardly be expected that the courts, which are dependent in technical questions upon expert testimony, can prepare a suitable definition of engineering. There have been many attempts to so define the profession, and with indifferent success. Many such definitions specify special branches and wind up with a blanket clause at the end to cover all other branches of engineering, with the result that the branches of the profession previously designated might as well be omitted. It is a question how laws can be framed to effectively and properly regulate anything that cannot be definitely and comprehensively defined.

The divisions of engineering cover work of many varieties, many of which have absolutely no relation to each other, and nearly sixty different branches of engineering may be quoted by title. Most of the laws appear to make no distinction between the different fields of engineering activity, and the registered engineer in the eyes of the law may be equally competent to act as a chemical engineer, an electrical engineer, an efficiency engineer, a mechanical engineer, or a municipal engineer, all typical of most widely diversified branches of the profession.

In this connection, it is difficult to comprehend how a man registered as an engineer and whose principal knowledge is confined to, say, mechanical engineering, is any more qualified to pose as a chemical engineering expert than would be a lawyer, a physician or a plumber, for instance, or a person skilled in many other professions or trades, provided their general educational qualifications correspond.

A small percentage of the laws in effect require that applicants for registration shall be citizens of the United States, but the Engineering Council model law and the American Association of Engineers proposed laws contain requirements that such applicants shall be citizens of the United States or of Canada. Such a requirement is most provincial, and is distinctly opposed to Massachusetts law and precedent in particular, which requires applicants for registration in other professions to be only of good moral character, in addition to educational or professional qualifications. Such requirement savors strongly of the "closed shop" of the labor unions, is most unfair discrimination in favor of Canadians as against other British subjects, and furthermore is extremely un-American. American engineers should certainly not be so narrow-minded as to fear foreign competitors or oppose their registration, and may learn much by association with men conversant with foreign technical practice.

Some of the proposed laws provide that structures or work costing less than a certain sum need not be designed by a registered engineer. The safety of the public may be vitally endangered in many instances by an inexpensive structure. Some of the laws also provide that structures may be built by owners, whether persons or corporations, on their own property, which are not designed by registered engineers. It may be noted that in all localities where building laws are deemed necessary, it is doubtful that a building law can be found that will allow a man to build for his own use or occupancy a house that is not constructed in conformity with the building code of such city.

Laws for the licensing of engineers should also include the licensing of architects and affiliated professions, for the reason of the two professions being so closely interwoven that they are mutually interdependent in many ways. An architect must be more or less familiar with many branches of engineering, and an engineer is frequently obliged to consider the architectural appearance of his structures.

Fees for registration and annual renewal of licenses, where the latter are required, is a not unimportant item of expense to many.

Believing that legislation will again be requested, the undersigned committee recommends that it or a similar one be continued during the coming year, to further study the matter of licensing or registration of architects, engineers and land surveyors, and that other engineering or architectural societies be invited to add their representatives to its membership and so continue a joint committee on the licensing of the members of such professions.

In conclusion we desire to state that in presenting this report we have endeavored to take no partisan view, but merely to give to the members of our respective societies an accurate perspective of the history of this case and a description of the things that took place at the hearing referred to, together with a few thoughts on the principle of licensing.

Respectfully submitted,

JOINT COMMITTEE ON LICENSING ENGINEERS.
(Majority of 12 of the 13 members.)

CHARLES T. MAIN,
CHARLES M. SPOFFORD,
CHAS. R. GOW,
CHARLES W. SHERMAN,
I. E. MOULTROP,
EDWIN H. ROGERS, *Chairman,*
Representing Boston Society of Civil Engineers.

L. W. ABBOTT,
Representing Boston Section, American Institute of Electrical Engineers.

ARTHUR L. WILLISTON,
Representing Boston Section, American Society of Mechanical Engineers.

C. H. BLACKALL,
Representing Boston Society of Architects.

ALLEN HUBBARD,
Representing Boston Section, American Society Heating and Ventilating Engineers.

EDWARD E. BUGBEE,
Representing Boston Section, American Institute Mining and Metallurgical Engineers.

BREMER W. POND,
Representing Boston Society of Landscape Architects.

APPLICATIONS FOR MEMBERSHIP.

[June 15, 1921.]

The By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

Maxwell, Harold Frederick, Dorchester, Mass. (Age 26, b. Malden, Mass.) Had a three years' course in civil engineering at Northeastern College, 1913–1916. Since that time he has been in the employ of the State, in the Department of Public Works, Division of Highways, as rodman, transitman, and later as assistant resident engineer. From the latter part of 1917 to January, 1919, he was with the 101st U. S. Engineers, A. E. F., and after his discharge he returned to the Public Works Dept., and is at present assistant to the construction engineer, District No. 4. Refers to A. B. Appleton, R. W. Coburn, L. B. Hoyt, and A. P. Rice.

LIST OF MEMBERS.

ADDITIONS.

Allen, John S.	Walpole, Mass.
Dufour, Frank O.	147 Milk St., Boston 9, Mass.
Flynn, Francis T.	141 Millet St., Dorchester, Mass.
Macaulay, Ralph F.	1996 Mass. Ave., Cambridge 40, Mass.
MacWilliams, Harold F.	360 High St., Newburyport, Mass.
Ryan, Edward J.	703 City Hall Annex, Boston 9, Mass.
Steward, Douglas P.	90 Forest St., Medford, Mass.
Vaughan, John F.	185 Devonshire St., Boston, Mass.

CHANGES OF ADDRESS.

Ford, Arthur L. . . . . 9 Sutton Ave., Juniper Pt., Salem, Mass.
Jones, Frederick E. . . . . 80 Elm St., W. Somerville, Mass.
Kimball, Herbert S. . . . . 79 Milk St., Room 1111, Boston 9, Mass.
Leland, Franklin E. . . . . 155 Newbury St., Roslindale, Mass.
Rhodes, Ralph F. . . . . U. S. Engineers' Office, Savannah, Ga.
Tosi, Joseph A. . . . . 84 Bay State Road, Worcester, Mass.
Van der Pyl, Edward . . . . 63 Barber Ave., Worcester, Mass.
Wilber, Joseph F. . . . . 210 South St., Boston, Mass.

DEATHS.

Nowell, Frank J. . . . . May 25, 1921

LIBRARY NOTES.

Recent Additions to the Library.

U. S. Government Reports.

International Congresses: Civil Engineering at Exposition, Brussels. 1910.

International Congresses: Ocean and Inland Navigation. 1913.

International Congresses: Rivers, Canals and Ports. 1912.

International Congresses: Shipbuilding from its beginning. (3 vols.) 1895–1905.

International Congresses: 12th Congress: 1st Sec. Questions.

International Congresses: 12th Congress: 1st Sec. Communications.

International Congresses: 12th Congress: 2d Sec. Questions. 1912.

International Congresses: 12th Congress: 2d Sec. Communications.

Triangulation in Rhode Island. Serial No. 121. By Earl Church.

Water Supply Papers Nos. 466, 481, 500-A.

State Reports.

Vermont. Special Report Water Resource Commission. 1921. By State Engineer in coöperation with C. H. Pierce, Dist. Engr. U. S. Geol. Survey.

Municipal Reports.

Chicago, Ill. Report on Industrial Wastes. Vol. 2. 1921.

Haverhill, Mass. Annual Report Board of Water Commissioners. 1920.

North Adams, Mass. Annual Report City Officers. 1920.

Northampton, Mass. Annual Report Water Commissioners. 1920.

St. Paul, Minn. Annual Report Board of Water Commissioners. 1920.

Springfield, Mass. Annual Report Water Commissioners. 1920.

Springfield, Mass. Report Municipal Water Works. 1920.

Wellesley, Mass. Annual Report Water and Municipal Light Commissioners. 1920.

Miscellaneous.

American Engineers in France. William B. Parsons. (Gift of Clemens Herschel.)

Further Incidents in the Life of a Mining Engineer. E. T. McCarthy. (Gift of Clemens Herschel.)

Finding and Stopping Waste in Modern Boiler Rooms. Cochrane Corp.

Forests of British Columbia. Commission of Conservation. Canada.

The Canadian Oyster. Commission of Conservation. Canada.

LIBRARY COMMITTEE.

Vol. VIII JUNE, 1921 No. 6

BOSTON SOCIETY OF CIVIL ENGINEERS
FOUNDED 1848

PAPERS AND DISCUSSIONS

This Society is not responsible for any statement made or opinion expressed in its publications

THE PUBLIC WORKS OF MODERN GREECE.

By Walter E. Spear,* Member Boston Society of Civil Engineers.

* Board of Water Supply, City of New York, N. Y.

(Presented April 20, 1921.)

With a staff of American and Greek engineers, the writer, as the representative of Ford, Bacon and Davis, Engineers of New York City, made, last year, an investigation in Greece for a complete system of water supply and sewerage for the cities of Athens and Piræus. Compared with the eastern part of the United States, Greece is a very dry land. The entire annual rainfall is small; that during the summer almost negligible, and all available water not required for the needs of men and animals is used for irrigation. The problem of developing an adequate supply of water for a population of 370,000 people, now living in the above communities, without prejudice to other interests, was not, therefore, a simple one, and all possible sources of supply within 100 miles of Athens were considered. These investigations took the writer over a large part of Southern Greece and gave him an opportunity to see something of the existing public works and to learn from some acquaintance with public men the needs of modern Greece.

Need for Modern Public Works.

Modern Greece has a few handsome public buildings, as seen in Fig. 1, some well-paved city streets, an insufficient mileage of indifferent highways, a few trolley roads and an inadequate railroad system, but really possesses no modern public works comparable with those of the progressive countries of modern Europe. Ancient Greece has left ruins of the most magnificent public buildings and monuments ever fashioned by man, some water works still in serviceable condition, a few drains and some traces of old highways. The Greeks, in their small city states, were not great road builders, and the Romans in their time did little in Greece, so that in the most essential requirement of a commercial state, adequate transportation, ancient Greece was ill-provided. As now, the great need in ancient times was money with which to carry on large public works. In classic Greece, huge sums were spent in beautifying the cities, and more productive public works were neglected. During the last eight years, modern Greece has spent large sums of money on its army when it could have better been spent on water, sewerage and drainage works, more and better highways, additional railways and improvements of existing lines, and extensive port developments.

FIG. 1. ACADEMY OF SCIENCE, ATHENS.

Water Works.

With an annual rainfall over large areas of Southern Greece of less than twenty inches, most of which falls in the months of October to May, inclusive, and with a high percentage of run-off from rocky, mountain slopes and semi-impervious soils, the amount of water available during the long, almost rainless summers is consequently small. Surface reservoirs for the storage of the winter rains have seldom been constructed, and the conditions are not generally favorable for such construction. The underground storage in the seams and channels of the limestones and shales of the mountains and in the occasional beds of porous gravels and conglomerates of the large valleys is insufficient to maintain the flow of the springs, which, with wells, provide water throughout the year for all purposes, and the yield of these springs falls off very materially toward the end of the summer.

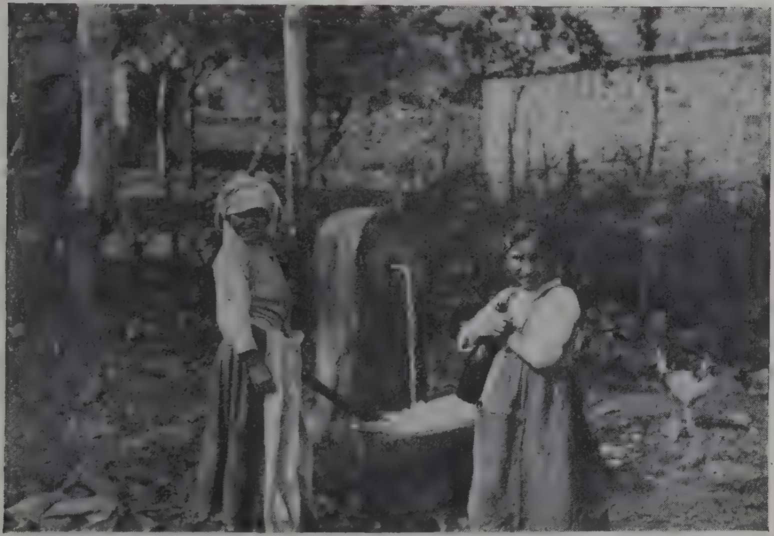

FIG. 2. FOUNTAIN IN VILLAGE OF SOUVALA, NEAR MT. PARNASSUS.

Outside of the larger cities, water is seldom piped to private dwellings; every householder carries his supply from the constantly flowing fountains, shown in Figs. 2 and 3, which are so conspicuous a feature of the Greek villages. Often the container is a 5-gallon can provided by the Standard Oil Company. The water from these fountains appears to be of a satisfactory quality, except for the universal hardness. It is generally cool, though an agreeable temperature cannot be long maintained without ice during the heat of the summer, even when placed in porous jars. The amount of water actually used in these villages is naturally small, but none is lost, since the overflows of the fountains irrigate the village gardens and perhaps the fields outside. When the larger villages in Greece, which are now favored with sufficient water for their public fountains, install modern plumbing and begin to use as much water as other Mediterranean communities in France, Italy, or even in Egypt, it is going to be difficult to find sufficient water for their needs. Some villages, to which most of the water used is hauled several miles in barrels, may never be able to procure enough water to greatly raise their present standard of cleanliness. In some localities surface water might be developed, but the prejudice against its use for domestic consumption is very strong and cannot be readily overcome.

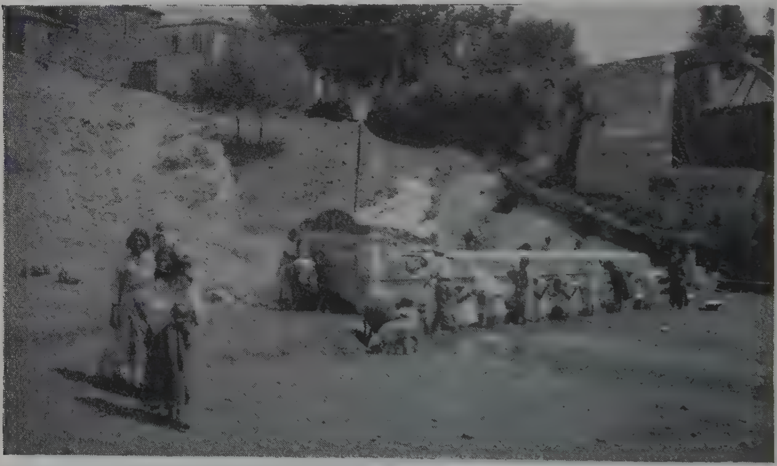

FIG. 3. FOUNTAIN AT THEBES.

The largest problem in water supply in Greece, and one that has been considered for some years by the Greek government, is that of providing an adequate supply of water for the cities of Athens and Piræus. These cities sometimes have during a dry summer but little more than ten gallons per capita, quite insufficient for their needs. Most of the Athens supply is furnished by the aqueduct and galleries, some 16 miles in length, that were built in the second century of this era, during the reign of the Emperors Hadrian and Antoninus Pius. The covered reservoirs at the end of the Hadrian aqueduct are seen in Figs. 4 and 5. The Hadrian aqueduct was built as a tunnel through the limestones and conglomerates of the hillsides and valleys back of the city and is in some places 120 feet below the surface. The supply from this aqueduct is extremely hard but otherwise satisfactory. Some additional water for Athens is provided by large open wells in the vicinity, and all of the inadequate supply delivered to Piræus comes from similar sources near that city, which provide a water much inferior in quality to the supply of Athens.

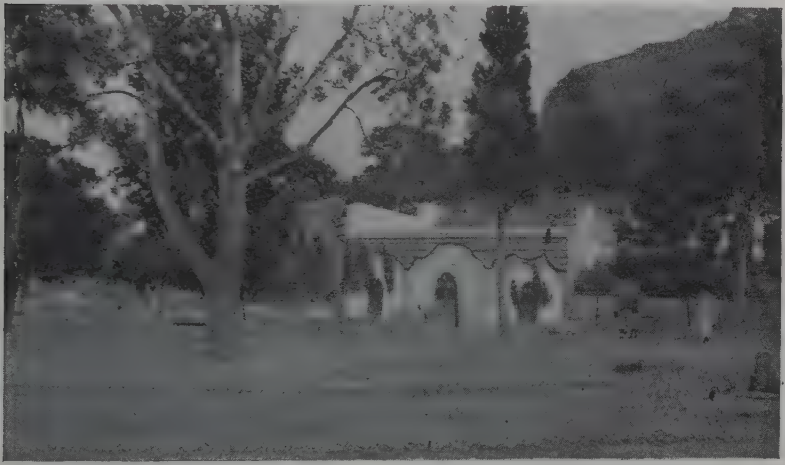

FIG. 4. STORAGE RESERVOIR IN ATHENS, AT END OF HADRIAN AQUEDUCT.

Most of the new sources of supply proposed for Athens during the past thirty years or more have been distant springs, the immediate development of which would represent a heavy burden upon the financial resources of the cities to be served.

English, French and Austrian engineers have from time to time reported on the project of bringing to Athens and Piræus a supply of 20 million gallons or more of water from the springs near Lake Stymphalia, in the Peloponnesus, some 70 miles away in a straight line. The springs are at an elevation of about 2 000 ft. and may be brought to Athens by gravity, but at the Isthmus of Corinth the necessary siphon at approximately sea level would be subjected to a very heavy pressure to deliver the water in Athens at the level required. Other sources that have been suggested are large springs in Bœotia, at the headwaters of the Melas River in the basin of Lake Copais. These springs have an elevation of only 300 to 400 ft. above sea level and, though somewhat nearer Athens than those at Lake Stymphalia, would require pumping against a high head to get them over the Cithæron or Parnes mountains, lying between Bœotia and the plains of Attica, in which Athens is located. The writer reported on still another source of supply somewhat farther away than either of the above, on the slopes of Mt. Parnassus, at an elevation of about 1 000 ft. The valley in which these springs occur is seen in Fig. 6. These sources, which would supply fully as much water as those at Lake Stymphalia, may be brought to

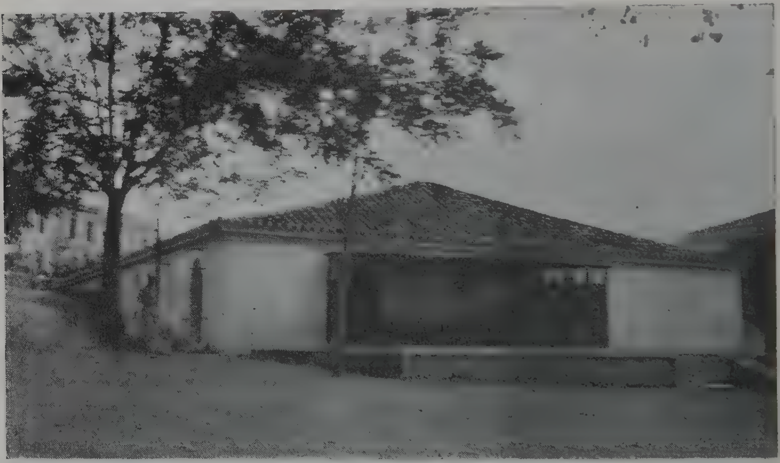

FIG. 5. STORAGE RESERVOIR IN ATHENS, AT END OF HADRIAN AQUEDUCT.

Athens in a gravity aqueduct that could be located over much more favorable ground than that from Lake Stymphalia, and a first development of surface water could be made along this aqueduct not far from Athens, at a favorable site for a large storage reservoir, which would serve to equalize the flow of the springs of the Parnassus sources. This development of surface water would represent a first step in the construction of the entire project.

FIG. 6. VALLEY NEAR MT. PARNASSUS.

Sewerage.

Modern sewerage works can hardly be said to exist in Greece outside of Athens and in some of the other large cities, and there is little likelihood of any immediate construction of sewerage works except in Athens and Piræus. The general demand for modern sanitation does not appear to be sufficiently great to keep the cities and villages clean with their present facilities or to overcome in many localities the difficulty of finding sufficient water for modern sewerage works, or of securing enough money to build them.

Some traces of the sewers of ancient Athens have been found, but these sewers, dating back to the fifth century B. C., were probably built for storm-water drains and were not intended for the carriage of house sewage. Portions of modern Athens have storm-water drains which carry house sewage, though they were not intended for that use and are ill-designed for the purpose, having large and irregular sections and flat inverts. They are all built of rough rubble, plastered on the inside. A view of the outfall sewer of Athens, which carries the sewage to the channel of the Cephisus and to the irrigating ditches below it, is seen in Fig. 7. Large areas in Athens are served by cesspools, and more primitive methods of disposal in open privies or pits are common in the poorer quarters. The need of Athens for a modern system of sewers is great, and proposals have been repeatedly made to provide such works. A few years ago, a German engineer prepared plans for a combined system of sewers for Athens and Piræus. The writer, however, after consideration of the problem, adopted a separate system and prepared plans and estimates on that basis. This solution of the problem promised a more satisfactory method of disposing of the house sewage in a city surrounded by steep, rocky hillsides, from which the heavy winter rains would wash into a combined system of sewers so much

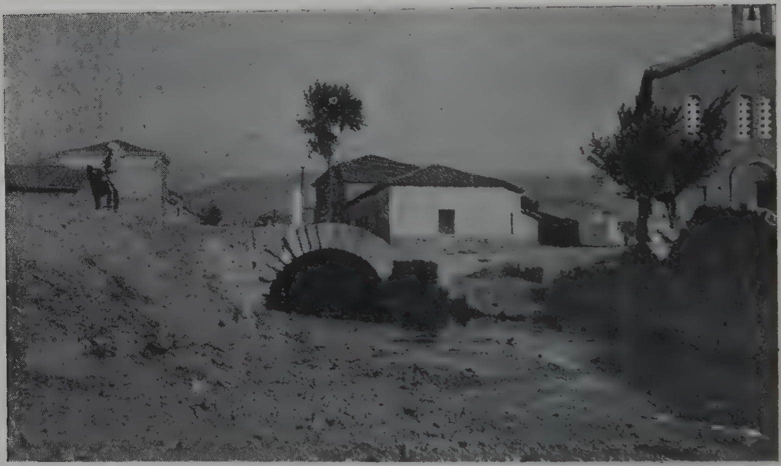

FIG. 7. OUTFALL SEWER NEAR DANIEL'S CHURCH, ATHENS.

detritus as to obstruct the summer flow of house sewage and create a nuisance.

The adoption of the separate system would permit the use of the existing sewers as a part of the storm-water drainage system, and would allow of safely discharging all storm water in Athens through comparatively short connections into the adjacent channels of the Ilissus and the Cephisus, and that in Piræus directly into the harbor. The difficulties of tearing up the narrow, tortuous streets of Athens and Piræus, such as are seen in Fig. 8, and of laying sewers and storm-water drains as well as water mains there, may only be appreciated by those who have faced some such task elsewhere, and know besides something of local conditions in these Greek cities. The work would necessarily involve careful planning and thorough organization, not to speak of a large expenditure of money.

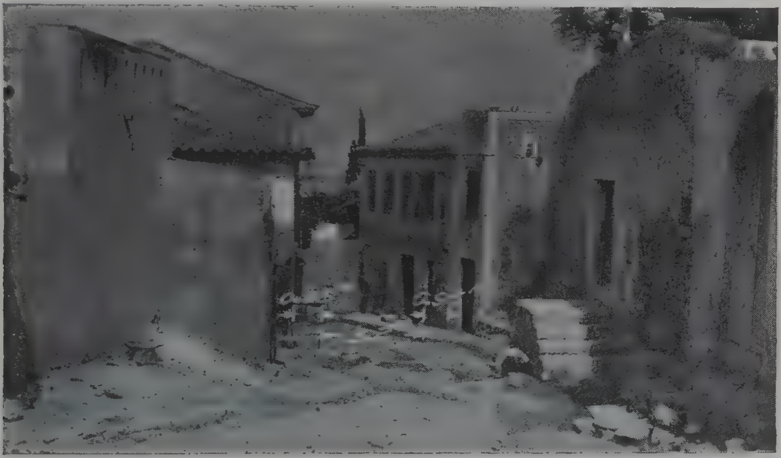

FIG. 8. NARROW STREET IN OLDER QUARTER OF ATHENS.

Drainage.

Although Greece impresses the visitor as an exceedingly dry country, there are several large marshy districts like that seen in Fig. 9, and countless small, wet areas about wells, springs and irrigation channels which must be thoroughly drained to eliminate the mosquito and get rid of the malaria. This disease is a real scourge in some parts of Greece and represents perhaps the most serious public health problem there.

Some fifteen to twenty years ago, Lake Copais, in Bœotia, was drained by an English company and the bed of the lake, an area of about 100 square miles, was made available for agriculture. The project as worked out requires pumping during the winter months to prevent flooding the bottom lands, and it has not been, it is said, altogether successful financially, a result which has tended to discourage similar ventures of this kind. It is of interest to note that when the English company uncovered the bottom of Lake Copais, they found evidences there of old villages and canals that may well have existed before the coming of the Greeks and which demonstrated that in the remote past the lake had been drained before. There are many other drainage projects in Greece awaiting attention, — one project, that of completing the draining Lake Stymphalia in the Peleponnesus

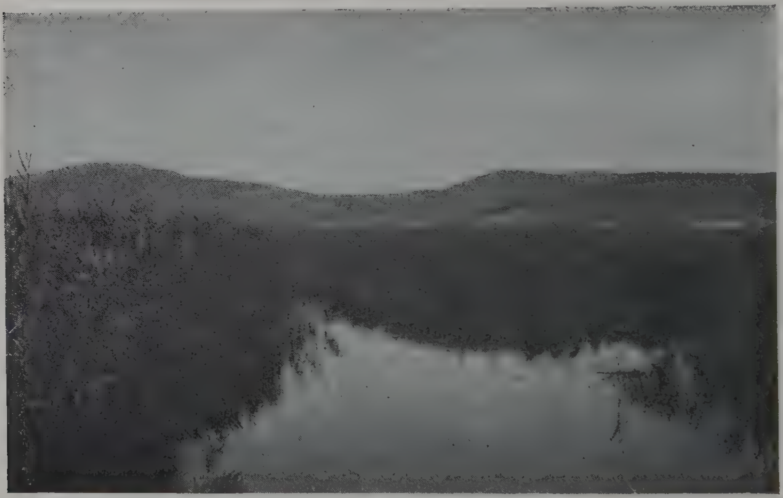

FIG. 9. SWAMPS ON MELAS RIVER IN LAKE COPAIS BASIN.

(Fig. 10), where Hercules performed the fifth labor. This project is said to have been originally carried out under the direction of Emperor Hadrian, but the tunnel driven in the second century becomes obstructed from time to time and must be enlarged and lined. The former government of Mr. Venizelos was considering, among other projects, the drainage of the swamps of the Vardar River in Macedonia, and an English firm submitted a proposal to make the necessary preliminary surveys and work out the plans for this improvement. In Macedonia there are other opportunities in which the government would like to interest capital. It was proposed in a report to former Premier Venizelos that the government should grant large areas of land there to foreign capitalists, with the understanding that they would drain, irrigate and farm these lands, and eventually dispose of them with the equipment to groups of peasant proprietors.

FIG 10. LAKE STYMPHALIA.

Irrigation.

The area of land under cultivation in Southern Greece can hardly be increased, as every patch of land capable of cultivation seems to be farmed. No water can be applied to most of the land during the long rainless summers, and, except for the areas devoted to the culture of the vine and the olive, which need no irrigation, but one crop is grown each year, generally grain, which is sown late in the fall and harvested in July. Every drop of water from the summer flow of the springs and from many wells is now utilized, not always to the best advantage, as the free flooding of border method is generally used in handling the water. The problem is obviously to increase the amount of irrigable land by constructing storage reservoirs in which to carry over the winter rains that now, to a large extent, go to waste. There are some difficulties, however, in creating the necessary storage reservoirs, as the mountain valleys are generally steep and narrow, and the porous, seamy limestones of the country make the construction of tight reservoirs something of a problem. There are, however, to the writer's knowledge, a few very promising reservoir sites, and no doubt the physical difficulties of making tight reservoirs may be overcome.

In the Attica plain, water from the Cephisus is sold for irrigation at a price of 48 drachmas per strema (1,000 sq. melas) for a season's irrigation if twelve applications are made, which is equivalent to $37 per acre at normal rate of exchange. This gives some idea of the value of water in that country. Back in the country the water is owned and controlled by the small villages and only a nominal charge, if any, is made to cover the care and management of the ditches.

Roads.

Between the small city states of classic Greece, communications were poor and a system of cart roads over the entire country did not exist. Back in the mountains the writer has seen some excellent examples of ancient highway construction, of well-cut, irregular, polygonal blocks which happen to have been preserved through accident of drainage. Most of these old roads have been eroded and washed away because sufficient drainage was not originally provided, a fault in road construction that is still observable in modern Greece, and, indeed, not unknown in our own country. Most of the existing highways are of comparatively modern construction, and it is not clear just why many of the mountain roads without gutters and adequate culverts do not entirely wash away during the winter. Certain it is that it is no pleasure to travel over them and, in the general absence of guard rails on bridges and steep mountain sides, it is not very safe to do so. A view of the road over Mt. Cithæron is seen in Fig. 11. The much despised Turk appears to have done not a little road-building in his time and has left some very creditable bridges, a form of construction in which the Greek of to-day, as in the past, does not appear to excel. One of these old bridges is shown in Fig. 12.

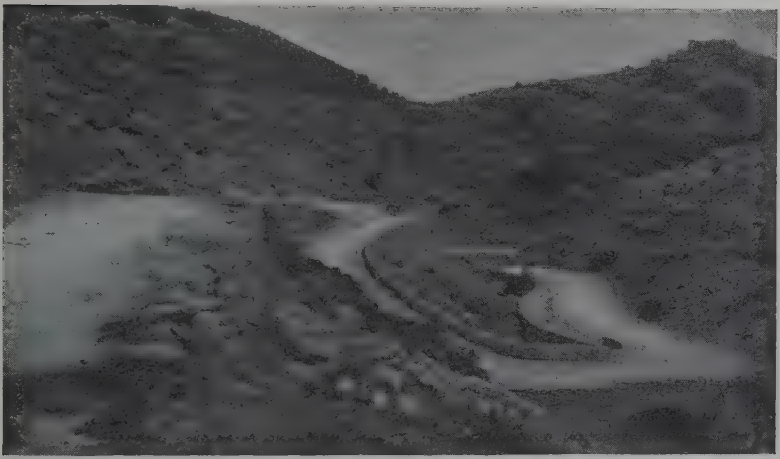

FIG. 11. ROAD OVER MT. CITHÆRON.

The large cities of Greece have some admirably paved streets, generally asphalt, but even in the cities and everywhere outside, with the exception of one short piece of road near Athens, the highways are surfaced with water-bound macadam, some of which is constantly being repaired and as quickly destroyed. Sometimes the destruction is the result of the torrential winter rains, but not infrequently it is done by heavy motor traffic, busses and trucks. I suppose that nowhere is the strain of eight years of war in Greece seen more clearly than in the neglect of their roads. Some important highways of macadam construction are now quite impassable, even with a Ford. In the vicinity of Athens there has been recently a large increase in the use of heavy motor busses to the surrounding towns, and that, with the automobiles and motor trucks, all driven at a pace that alarms the visitor, is destroying the roads more rapidly than they can be repaired. A road built of soft limestone rock, with a filler of sand and dust of the same material, cannot be expected to stand up long in the dry summer when it sometimes does not rain for weeks at a time.

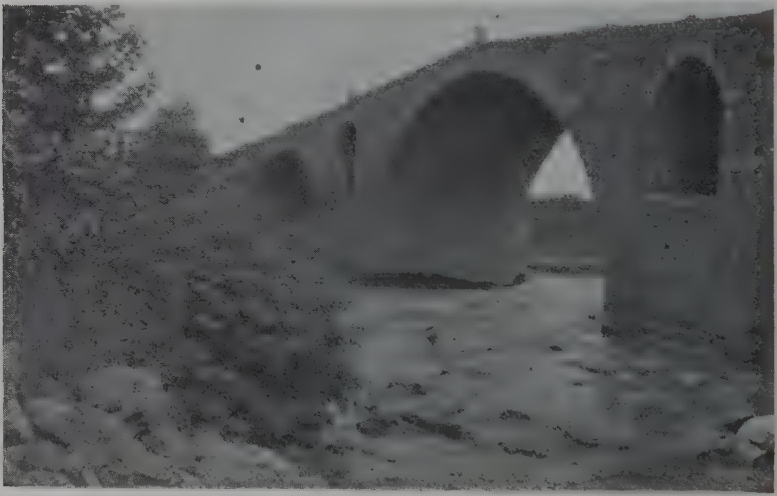

FIG. 12. OLD TURKISH BRIDGE NEAR MT. PARNASSUS.

Some new road construction was being carried on by the government last fall through a contract with an English firm, one road near Athens, another back in the mountains. Both were being surfaced with water-bound macadam. No doubt, if the hopes of the Greeks are realized and oil is discovered in Greece, some improvement in the character of construction may be looked for.

Railroads and Canal.

Except for the Larissa railroad, running from Athens to Salonica and thence to Europe and Constantinople, all railroads in Greece are narrow gauge. The Larissa railroad is of French construction and well built and operated, though, in common with all European roads, somewhat lighter than ours. A view at one of the stations on this road is seen in Fig. 13. The government proposes to acquire the railroads of the country, but the lack of funds will probably prevent this for some time. The railroads have been using English and American bituminous coal, some of it being briquetted to minimize waste. The only fuel available in Greece is a very poor quality of lignite, but some success has been recently reported in briquetting this. The discovery of oil would mean much to the railroads.

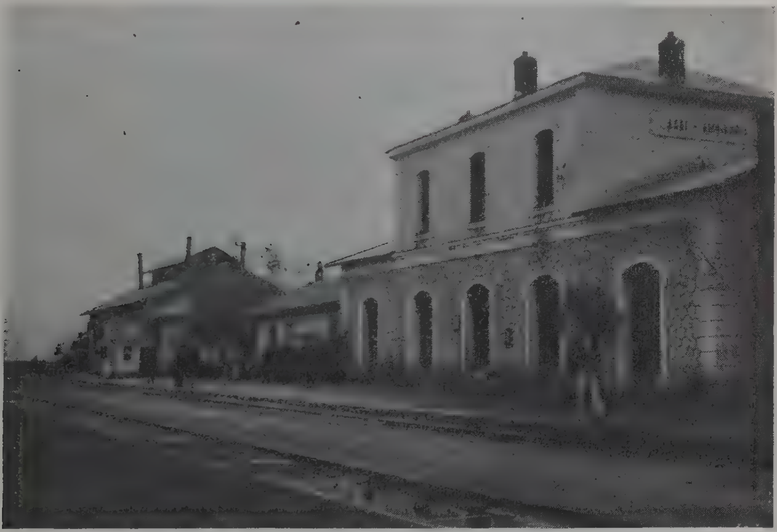

FIG. 13. STATION AT DADI ON LARISSA RAILROAD.

The short railroad between Athens and Piræus, one of the best in the country, is electrified, and the government has plans for further electrification near Athens when other lines are acquired. All current for railroad, street cars, lighting and commercial uses in the vicinity of Athens comes from a steam plant near Piræus.

Greece has one very famous canal, that crosses the Isthmus of Corinth, which connects the Gulf of Corinth with the Saronic Gulf. The ancients considered the project of a canal across the Isthmus, and some traces of the work done under the Emperor Nero may still be seen. Little was accomplished. They had to content themselves with a small ship railway. Not until 1881 was the excavation of a canal seriously undertaken again by a French company and finally finished by the Greeks some ten years later. A view of the canal from the railroad and highway bridge over it is shown in Fig. 14. The total length of the canal is 3½ miles, of which one mile is in rock. The waterway is 100 ft. wide and 26 ft. in depth, only sufficient for small vessels.

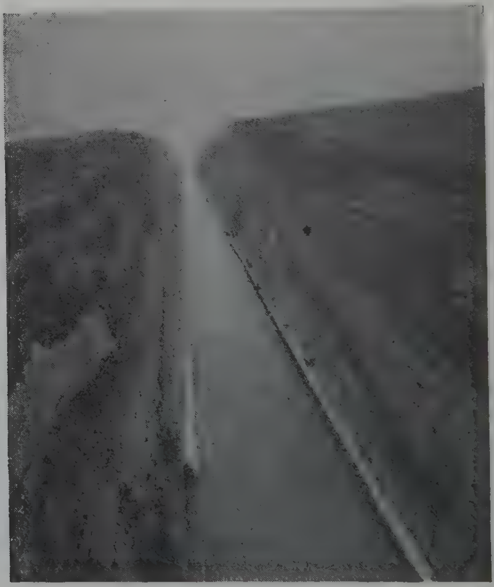

FIG. 14. CORINTH CANAL.

The channel of the Euripus at Chalkis, between the island of Eubœa and the mainland of Bœotia, though not a canal, is a very important channel for small craft. It has recently been widened and made safe for navigation.

Hydroelectric Power.

Hydraulic power is very generally used in Greece for grinding grain and for rug-beating. One of the water wheels which is typical of those seen throughout the country is shown in Fig. 15. There are very few hydroelectric plants. One near the city of Lamia that came within the writer's knowledge represented a very incomplete development of a stream fed by high mountain springs. This was an Italian development and the power was used largely at an adjacent carbide plant. Macedonia offers a large field for hydroelectric development, and a report is now being made by a Greek group with foreign backing, supposedly with a view to obtaining a concession.

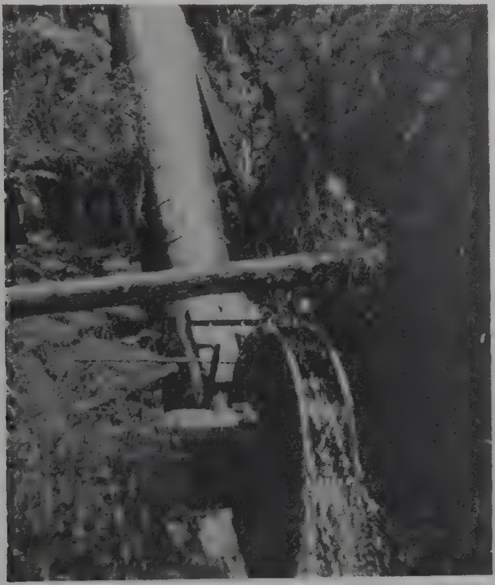

FIG. 15. WATER WHEEL NEAR SOUVALA.

Port Improvements.

The foreign commerce of Greece is greatly hampered by inadequate port facilities. Improvements are proposed by the government at Piræus, Kavala, Dedeaghatch and other ports. The need of improvements at the harbor of Piræus is great. The delays in getting freight through this port are almost unbelievable. At least a month is generally required, however urgent is the need for goods or equipment. All ships lie out in the harbor and all goods are lightered. Every one of many transfers between the ship and the customhouse means a fee for some of the army of port workers.

Three English firms submitted plans and proposals last fall for the construction of an extensive system of docks in the harbor, the period of construction to cover a number of years, so as not to interfere unduly with traffic. No award has been made by the present government as far as known.

Construction Conditions.

Greece is a poor country, with few natural resources upon which to build a large program of public improvements. The lack of money for public works is no new thing in Greece; in ancient times, the Athenians had difficulty in making both ends meet. It must be recalled that, in the time of Pericles, Athens exhausted her modest resources in building the Parthenon and did not finish the group of buildings planned for the Acropolis. Some of the money used for this magnificent work represented contributions from her allies for making war against Persia, and was perhaps improperly used in spending it to beautify Athens. Whatever may have been the justice of this financial program, this was at least one case where the end justified the means. If Greece now succeeds in retaining the rich lands in Thrace and the Smyrna hinterland which were awarded by the treaty of Sèvres, the government will some day, according to former Premier Venizelos, have a very handsome national income, but, for the present, foreign assistance is evidently needed for carrying on public improvements.

Concessions.

For most public works the declared policy of the government under the Venizelos régime was to require the contractor seeking to do public works to furnish at least 50 per cent. of the capital required. Not only would such a plan conserve the financial resources of Greece, but it would tend to keep the wealth of the country at home. It has been the practice of the government in providing security for a foreign loan to pledge certain public revenues to insure the payment of principal and interest. In granting a concession covering a period of operation of public utilities the policy of the government appears to be to insist on the control of the enterprise by Greek citizens.

Materials of Construction.

Except for stone, cement, possibly brick and a little lumber, all materials, machinery, tools and other equipment must be imported. No really good brick is made in Greece except some sand-lime brick for building, but there is no reason, with the materials available, why excellent brick and good vitrified pipe could not be made. Disregarding the expensive marbles, practically nothing but limestone is available as a building stone in Southern Greece, but this is a good serviceable material. The most serious problem there is to find any suitable sand for mortar or concrete. The sand commonly used is that found in small quantities in the stream channels or on the beaches. This sand is very largely limestone, and to our eyes a very poor material, but it has been successfully used for even hydraulic construction. For a large job, such sources would not furnish enough sand and some other solution of the sand problem would have to be developed. Possibly limestone crushed and rolled would give a satisfactory product. Two cement mills near Athens, one at Piræus and another at Eleusis, turn out a satisfactory Portland cement, and sufficient capacity may be developed in these mills for the largest construction project.

Trees in many sections of Southern Greece are conspicuous by their absence. The pine is the most common, but this is useless for lumber and would hardly answer for temporary timbering in tunnels. It is gashed ruthlessly to obtain the resin with which to preserve and flavor the native wine, and then it falls a victim to the woodchopper. The ubiquitous goat effectively prevents any new growth. The oak, which in ancient days was important for shipbuilding, is seldom seen, and other trees, such as the sycamore and the plane, are not plentiful and have little value. A little fir has been cut back in the high mountains, but practically all lumber required in the country is imported.

Construction Superintendence.

There are many able Greek engineers largely educated in France and Germany, but few with much experience on large public works construction. Any large project would therefore require foreign engineers, and the same is true of skilled superintendents and foremen for most work. It is of interest to note that the ministry of communications employed forty Swiss engineers last year.

Labor.

There is apparently no dearth of skilled labor, such as employed in the building trades. Steel workers need not of course be looked for. Only one steel frame building exists in Athens; most buildings are of masonry of massive design, rather poorly bonded and uniformly stuccoed to give the appearance of smooth cut stone. A few reinforced concrete buildings are being constructed in Athens, and satisfactory work is being done.

A serious difficulty in constructing large public works in Greece would be to find sufficient unskilled labor, and it would be necessary to import it. There is no surplus native common labor and wages are relatively high, about 300 per cent. of the pre-war scale. While a surprising number of Greeks have been in this country and speak an unmistakable American variety of English, the language difficulty would stand in the way of rapidly organizing a job under skilled American foremen. The output of labor, both skilled and unskilled, in Greece, is low. No one seems to be in a hurry. "Avrion," the manana of that country, is the appointed time for doing all things. Of course, the hot summer climate and the malaria discourage any continued and strenuous effort during the working season, and the most energetic of Americans would not do as much during the second summer as he did during the first.

American Opportunities.

In these times when so many American engineers find little to do at home, they may have to follow the example of the English and find increasing employment in foreign fields. In Europe, at least, we need not anticipate large opportunities unless American capital is more largely invested there. At present our people do not apparently care to invest their money abroad, and I fear we do not know how to go about it, anyway. The English make large foreign investments and seem to understand better than others how to obtain concessions. They do not seem to be afraid to spend their money abroad through fear of not being able to get it back. It seems to be well understood abroad that the English government does not hesitate to use all its influence to see that its citizens receive substantial justice, and that they therefore receive many privileges and opportunities denied to other nationals. The writer was credibly informed that the proposals on one project in Greece were restricted to English firms, and even had there been American firms interested in the project, they would have been excluded from the competition. In spite of the objections raised in high places a few years ago to "dollar diplomacy," our representatives abroad will have to practice some such diplomacy as this unfortunate phrase describes if American financiers and American engineers and contractors are going to have their share of the business in undeveloped foreign countries.

MEMOIRS OF DECEASED MEMBERS.

JAMES C. SCORGIE.*

JAMES C. SCORGIE was born in Aberdeen, Scotland, on August 2, 1850, the son of George and Helen Scorgie. He married Miss Anna Monson of Cambridge, and is survived by his wife and three daughters, Miss Anna Scorgie, Dr. Helen Scorgie and Miss Elvira Scorgie.

He died at St. Elizabeth's Hospital, Brighton, February 16, 1921, where he underwent an operation.

From his earliest school days at Aberdeen he evidenced exceptional ability in mathematics, and this led to his taking up work as a young man, with the Harbor Board, in the Paymaster's and Engineering departments, in which he assisted, as his first engineering experience, in the building of a breakwater at Aberdeen.

He came to this country in 1873 and began work in Cambridge as draughtsman and engineer for the largest granite builders in this vicinity. The erection of the State Insane Asylum at Worcester, Mass., and the Reformatory at Concord, Mass., were the larger buildings in which he assisted.

In 1880 he accepted the position of surveyor and engineer at Mt. Auburn Cemetery, later serving as Assistant Superintendent and then Superintendent, a continuous service of over forty years.

Mr. Scorgie was made Superintendent in 1896 and held that position at the time of his death. He was honored as one of the best informed men in his profession and a leader in the discussions and counsels of the Association of American Cemetery Superintendents, of which he was a member from its inception.

A natural student, he improved himself by the study of engineering during his spare time, and also took some special courses at Harvard and the Massachusetts Institute of Technology. His ability as a landscape engineer and his knowledge of horticulture is amply reflected to the visitors of Mt. Auburn Cemetery, and will be for years to come, as in this particular work the engineer rarely lives to see the completion of the picture which he builds for future generations.

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* Memoir prepared by John F. Peterson.

Mr. Scorgie designed and superintended the construction of a large concrete boundary wall on the western side of the cemetery, almost half a mile in length. He held the full confidence of his trustees and coworkers, and brought about numerous important improvements. He was the first to build bituminous roadways in cemeteries, and built up and enlarged a complete water supply for the cemetery, including pumping station, filter beds and necessary equipment to go with it; the administration building, chapel and crematory were built while he was Superintendent. These and all the necessary equipment for the best conduct of a cemetery were constantly receiving his study and attention, so that, to-day, Mt. Auburn Cemetery stands as the best equipped unit in this particular field.

He belonged to many societies and social organizations, including the American Society of Civil Engineers, the Boston Society of Civil Engineers, the Massachusetts Highway Association, the American Society of Cemetery Superintendents, the New England Society of Cemetery Superintendents, the Massachusetts Horticultural Society, the Horticultural Club of Boston, the Scots' Charitable Society of Boston, the Boston Scottish Society, and the Cambridge Club. He was a Mason and a Granger, and his chief interest in the past few years was his membership in the Unitarian Laymen's League, as he was interested in Cambridge as well as at his summer home in Harvard, Mass.

Mr. Scorgie was a student up to the day of his passing. He possessed a library rarely found in a private home. A man of sterling qualities, strong character and attractive personality, he leaves the community not only indebted for the work he accomplished, but for the very many pleasant and interesting interviews he gave to those who were fortunate enough to come in contact with him.

DAVID HERBERT ANDREWS.*

David Herbert Andrews was born in Pepperell, Mass., September 17, 1844, his father being the minister of the Congregational Church. He died at his home in Newton Center, Mass., on February 24, 1921.

Mr. Andrews was obliged to earn his own living early in life, and his natural inclinations led him to employment with machine shops in Worcester and Fitchburg. Believing a college education would be of great advantage to him, he prepared himself by night study to enter the Chandler School of Science and the Arts connected with Dartmouth College, graduating therefrom with the degree of Bachelor of Science in 1869. In 1908 he was given the Honorary Degree of Master of Arts by the same institution. Always greatly interested in the welfare of his alma mater, he was appointed in 1896 a member of the Board of Visitors of the Chandler Foundation and continued to serve in this position until his death.

After graduating from college he taught mechanical drawing in a night school at Fall River, Mass., later entered the employ, in the engineering department, of the National Bridge and Iron Works, situated in East Boston, Mass. As their engineer, he began a career notable for its part in developing the art of construction in iron and steel, then in its infancy, but destined to become one of the triumphs of American engineering. The pioneers in this industry were venturing in a new field with new materials, requiring new machinery and methods of manufacture and erection. They were called upon to design as well as construct, and they developed the theory as well as the practice of structural engineering.

An interesting example of the work designed by Mr. Andrews while with the National Bridge and Iron Works was the Boston train shed of the Boston and Lowell Railroad, afterwards incorporated as part of the North Station and finally removed in 1920, after forty-eight years of service. In 1872, at the time this shed was designed, the graphical systems of plotting the stresses in braced arches were not practically developed in this country, and the necessary computations for the arches of this roof were made from a study of a catenary chain distorted by weights hung over sheaves. The building of this shed caused considerable interest in engineering circles at the time and the structure when built was the most noted building of its kind in the country.

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* Memoir prepared by John C. Moses and J. Parker Snow.

The National Bridge and Iron Works met with financial difficulties and its affairs were wound up by receivers in 1876. Mr. Andrews bought the tools and machinery with borrowed money and founded the Boston Bridge Works, with its shop in East Cambridge, Mass. As its sole proprietor he now proved himself a business man of great ability, soon achieving financial success as well as a wide reputation for the workmanship of his structures, a large proportion of which were also designed by him and his engineers. This reputation and success were founded upon his industry, strict attention to business and to the confidence that he inspired in every one — employees, capitalists, supply firms and customers — of his entire reliability and strict integrity. A list of the work done during the first twenty years would comprise most of the railroad and highway bridges of New England and a considerable number in other parts of the country. The first steel buildings in Boston would also be included. His talent for invention produced the first derrick car for bridge erection in the early eighties, and a new type of locomotive turntable that is still in wide use. His plant was completely destroyed by fire in 1896, but, not discouraged, he immediately started plans to rebuild, and after personally making a study of the best plants in the country, he designed his new factory and supervised its construction in every detail. In 1901 he incorporated The Boston Bridge Works, remaining its president until his death and being succeeded in that office by his son, John G. Andrews.

Mr Andrews' professional and business life covered a period of fifty years, during which time the use of iron and steel increased many fold. It required courage and industry technical skill and practical common-sense to succeed in the early days, and this record is made as an example and encouragement for those who now take up the work that has been begun for them.

Mr. Andrews served as Chairman of the Chelsea School Board during his residence in that city. He moved to Newton Center in 1890 and took an active part in the church and civic affairs of that community. He was elected a member of the Boston Society of Civil Engineers in 1881, and was a member of the Engineers Club of Boston. He was also a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, the Boston City Club, and of other civic and social organizations.

Mr. Andrews was married in 1872 to Miss Clara Gilbert, of Concord, N. H., who survives him, as do also a daughter and three sons, two of the latter having been long associated with their father in his business.

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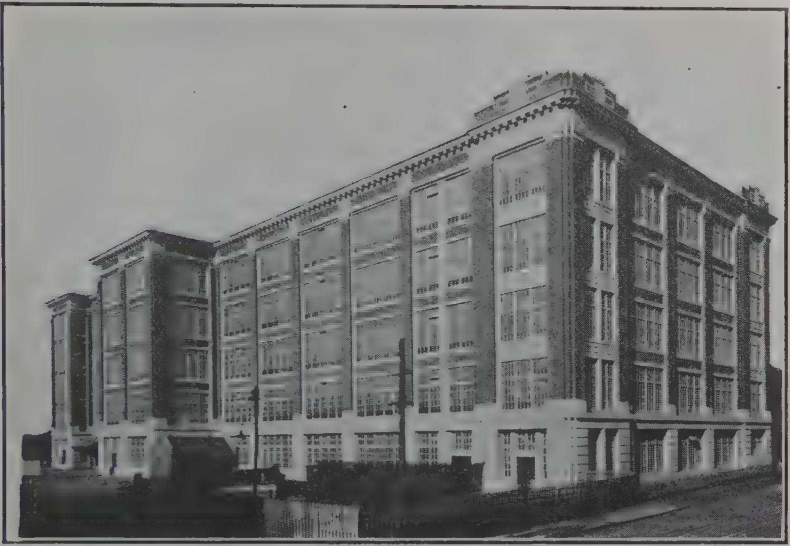

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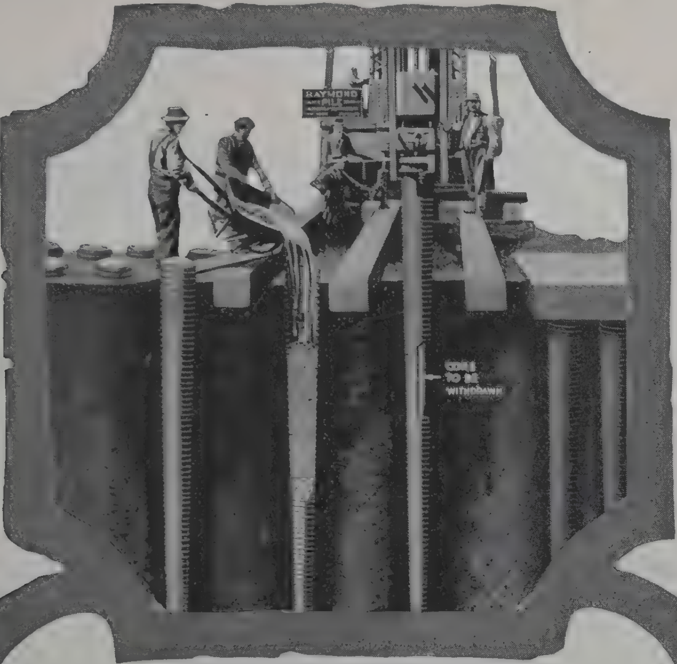

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